

INTERNAL JUGULAR VEIN ACCESS FOR HEMODIALYSIS USING DUAL-LUMEN SILICON CATHETERS WITH DACRON CUFF

Mamun Y. Ezzibdeh, FRCS; Ali Abou Zallat, PhD; Ibrahim Al-Oraifi, FRCS;
Siddig A. Egail, FRCS; Adel K. Al-Dayel, FACHARZT;
Essam El Sayed, MD; Sami Abu Anz, MD

Central vein catheterization is an established procedure to obtain vascular access for acute and chronic hemodialysis. In 1961, Shaldon et al. described cannulation of the femoral vein, and in 1969 Erben et al. used the subclavian vein to obtain vascular access. More recently, the use of internal jugular vein (IJV) double-lumen silicon catheters with Dacron cuff for temporary and permanent access has been introduced. The femoral vein catheters are far from ideal, since the femoral region restricts patient mobility, is prone to infection, and catheters are usually removed at the termination of dialysis, which results in a large number of catheter insertions over a short period of time. Subclavian vein cannulation is associated with subclavian vein stenosis and occlusion. Cimochowski et al. and Schillinger et al. found a high prevalence of subclavian vein stenosis, ranging from 40%-50%, which is significantly higher than the rate resulting from cannulation of the internal jugular vein (0%-10%).

Materials and Methods

All end-stage renal failure patients who had internal jugular vein silicon dual-lumen catheters with Dacron cuff (Kimal LTI Products) placed over a three-year period, between 1994 and 1996, were the subject of this study. Catheters were used for permanent access in patients following failure of conventional access, and in patients with diseased peripheral blood vessels. Catheters were used for temporary access while awaiting the construction or maturity of an arteriovenous fistulae or graft.

The catheter was surgically placed either by a cut-down technique on the internal jugular vein, or via percutaneous cannulation, which is the preferred technique because it is simpler and avoids the need for neck incision. The patient was placed in the Trendelenburg position to prevent an air embolism. In the percutaneous technique, the internal jugular vein (mostly the right internal jugular vein for

anatomical reasons) was cannulated percutaneously under general or local anesthesia in the operating room with an 18-gauge needle. A J-shaped guide wire was passed through the needle, with the wire tip positioned in the right atrium with fluoroscopic guidance. The needle was then withdrawn, maintaining the guide wire in place. The skin puncture hole was enlarged with the tip of a scalpel blade by 2 or 3 mm. A tunnel was created bluntly in the subcutaneous tissue from the neck wound inferolaterally to the ipsilateral subclavicular area. The catheter was pulled through the tunnel to the neck until the Dacron cuff was approximately 1 cm inside the skin. The vein was dilated with tapered vessel dilator, and a split-sheath introduced over the guide wire. The catheter was then passed through the split-sheath introducer, and the tip of the catheter was fluoroscopically guided to the superior vena cava right atrial junction. The split-sheath introducer was removed, the catheter position was reconfirmed, and the guide wire was then removed. Both lumens were flushed with diluted heparinized saline and then filled with heparin, the concentration and amount of which depended on the manufacturer's specification and the size of the catheter used.

Removal of the catheters required infiltration of local anesthesia at the exit and careful dissection around the Dacron cuff to free it from the subcutaneous tissues and fibrous sheath. After removal, pressure was applied to the neck and the patient was required to remain in an upright position for a minimum of 2 hours to prevent a local wound and hematoma.

Results

During the study period, 194 catheters were placed in 140 patients (88 males and 52 females). The mean age of the patients was 48 years (range 6-85 years). Catheters inserted by the percutaneous technique were applied in 180 patients and by the surgical cut-down method in 14. The right IJV was used in 182 catheters. General anesthesia was used in 130 catheters, especially in cases where other access procedures were carried out, and local anesthesia was used in 64. Ten catheters were placed in eight selected patients for long-term access following the failure of a conventional access in six and severe atherosclerosis of the peripheral blood vessels in two patients. These catheters

From the Department of Urology/Nephrology, King Fahd Military Medical Complex, Dhahran, Saudi Arabia.

Address reprint requests and correspondence to Dr. Ezzibdeh: Department of Urology/Nephrology, King Fahd Military Medical Complex, P.O. Box 946, Dhahran 31932, Saudi Arabia.

Accepted for publication 20 February 2001. Received 6 September 2000.

functioned for 6 to 36 months, and two catheters were replaced because of thrombosis. Two patients died with the catheters in place, and two had theirs removed following the creation of an alternative access in one patient, and a successful renal transplant in the other. Four patients had functioning catheters at the time of this study.

There were 184 catheters inserted for temporary access for emergency dialysis in 90 patients, and in 80 patients they were inserted at the time of creation of a permanent access. These catheters functioned for 3-120 days (mean of 64 days). The catheters were successful in providing adequate dialysis with blood flow of 180-300 mL/min, until permanent access devices were suitable for use in 70 patients (77.8%) of the emergency group and 72 (90%) of the other.

Infection was noted in 30 of the catheters (15.5%) used for short-term dialysis. Skin exit infection was seen in 7 catheters, 6 in the first 3 months following insertion, and all were resolved by topical povidone-iodine ointment. Tunnel infection was seen in one catheter 10 days after insertion and required removal. There were 34 episodes of bacteremia in 22 catheters, 10 episodes of which were documented in the first three months and 24 episodes after three months of insertion. Eleven catheters infected with bacteremia were cured by intensive intraluminal and intravenous antibiotics, and 11 that failed to conservative management were replaced or removed. Blood and/or catheter tip culture was positive in 22 infection episodes. *Staphylococcus epidermidis* was isolated in 55% of the episodes, *Staphylococcus aureus* in 18%, *Pseudomonas aeruginosa* in 9%, *Klebsiella pneumoniae* in 9% and *Streptococcus faecalis* in 9%. It is interesting to note that 19 infected catheters seen in patients with previously infected access (63.3%) required emergency IJV cannulation. Catheter sepsis was implicated in the death of two diabetic patients with multiple medical problems.

Catheter thrombosis occurred in 24 catheters (12.4%), and was the cause of line reversal in 18. Urokinase was used to de clot eight catheters and was successful in half of these cases. tPA was used in two catheters and dissolved the clot in one catheter. Guide wire was tried in six catheters, and one was salvaged. Minor hematoma that developed in two catheters required drainage. No major complications were encountered during the catheter insertion or dialysis, and no symptoms or signs of deep vein thrombosis were observed in any of these patients.

Discussion

The use of IJV dual-lumen silicon catheters with Dacron cuff for short- and long-term dialysis has many advantages. The placement technique is simple, the access is available for immediate use, repeated venipuncture is not required, replacement can be done around a guide wire, and sacrifice of arteries is avoided. The soft nature of silicon and the intra-tunnel Dacron cuff sealant allows prolonged placement of these catheters. Placement or re-insertion of catheters into the same site is possible. We have previously

replaced or reinserted catheters, or increased their number in the same vein.

Bacteremia and septicemia are the most serious complications, and 34 episodes were documented in 22 catheters. These complications become less significant when the number and/or the life-span of the vascular access is considered. Health care providers should follow the recommendations of the Hospital Infection Control Practice Advisory Committee, including the use of maximal barrier precautions (sterile gloves, large sterile drape, and sterile gown, cap and mask) and the use of skilled personnel to insert and maintain these catheters. Adherence to aseptic technique during insertion and maintenance of catheters remain the most important measures for the prevention of infection. Recently, antibiotics and silver-impregnated catheters have been designed to reduce the risk of catheter-related infections. Intravenous and intraluminal antibiotics are needed in patients with catheter-related bacteremia. In this study, 11 bacteremia-infected catheters were successfully salvaged with antibiotics.

Thrombosis of catheters, although not uncommon (24 catheters had thrombosis), was not a major problem in our study. Dec clotting procedures were successful in six catheters, and reversal around a guide wire under local anesthesia was carried out successfully in the remaining cases. In short-term dialysis, IJV dual-lumen silicon catheters with Dacron cuff are reliable in providing adequate and immediate dialysis, and should be considered until a permanent access becomes available for hemodialysis.

It is difficult to draw any conclusions from this study regarding the use of these catheters for permanent access. Only eight selected patients had them placed as such, however, four patients kept their catheter for more than one year, and in one case the catheter is still functioning after 36 months of insertion. These examples demonstrate their capability of functioning over a long period of time. Thus, these catheters deserve consideration as a maintenance access device in patients undergoing dialysis with diseased peripheral blood vessels. Further evaluation of these catheters for long-term angioaccess seems warranted.

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